

07-21-00

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Case Docket No. PHB 34,367

THE COMMISSIONER OF PATENTS AND TRADEMARKS, Washington, D.C. 20231

Enclosed for filing is the patent application of Inventor(s):
KEVIN BOYLE

For: BODY-WORN PERSONAL COMMUNICATIONS APPARATUS

ENCLOSED ARE:

- [X] Appointment of Associates;
 [X] Information Disclosure Statement, Form PTO-1449 and copies of documents listed therein;
 [X] Preliminary Amendment;
 [X] Specification (11 Pages of Specification, Claims, & Abstract);
 [X] Declaration and Power of Attorney:
 (1 Page of a [X]fully executed []unsigned Declaration);
 [X] Drawing (2 sheets of []informal [X]formal sheets);
 [X] Certified copy of GREAT BRITAIN application Serial No.9917678.6;
 [X] Authorization Pursuant to 37 CFR §1.136(a)(3)
 [] Other:
 [X] Assignment to U.S. PHILIPS CORPORATION.

FEE COMPUTATION

CLAIMS AS FILED				
FOR	NUMBER FILED	NUMBER EXTRA	RATE	BASIC FEE - \$690.00
Total Claims	9 - 20 =	0	X \$18 =	0.00
Independent Claims	1 - 3 =	0	X \$78 =	0.00
Multiple Dependent Claims, if any			\$260 =	0.00
TOTAL FILING FEE				= \$690.00

Please charge Deposit Account No. 14-1270 in the amount of the total filing fee indicated above, plus any deficiencies. The Commissioner is also hereby authorized to charge any other fees which may be required, except the issue fee, or credit any overpayment to Account No. 14-1270.

[]Amend the specification by inserting before the first line as a centered heading --Cross Reference to Related Applications--; and insert below that as a new paragraph --This is a continuation-in-part of application Serial No. , filed , which is herein incorporated by reference--.

CERTIFICATE OF EXPRESS MAILING

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 I hereby certify that this paper and/or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

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 Typed Name

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Atty. Docket

KEVIN R. BOYLE

PHB 34,367

Serial No.

Group Art Unit

Filed: CONCURRENTLY

Examiner:

Title: BODY-WORN PERSONAL COMMUNICATIONS APPARATUS

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

APPOINTMENT OF ASSOCIATES

Sir:

The undersigned Attorney of Record hereby revokes all prior appointments (if any) of Associate Attorney(s) or Agent(s) in the above-captioned case and appoints:

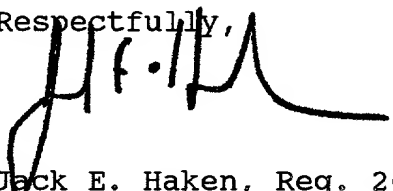
JACK D. SLOBOD

(Registration No. 26,236)

c/o U.S. PHILIPS CORPORATION, Intellectual Property Department, 580 White Plains Road, Tarrytown, New York 10591, his Associate Attorney(s)/Agent(s) with all the usual powers to prosecute the above-identified application and any division or continuation thereof, to make alterations and amendments therein, and to transact all business in the Patent and Trademark Office connected therewith.

ALL CORRESPONDENCE CONCERNING THIS APPLICATION AND THE LETTERS PATENT WHEN GRANTED SHOULD BE ADDRESSED TO THE UNDERSIGNED ATTORNEY OF RECORD.

Respectfully,


Jack E. Haken, Reg. 26,902
Attorney of Record

Dated at Tarrytown, New York
this 15th day of JULY, 2000.

003220-0333060

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Atty. Docket

KEVIN R. BOYLE .

PHB 34,367

Serial No.

Filed: CONCURRENTLY

Title: BODY-WORN PERSONAL COMMUNICATIONS APPARATUS

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to calculation of the filing fee and
examination, please amend the above-identified application
as follows:

IN THE CLAIMS

Claim 4, line 1, change "any one of claims 1 to 3" to
--claim 1--.

Claim 5, line 1, change "any one of claims 1 to 4" to
--claim 1--.

Claim 9, line 1, change "any one of claims 5 to 8" to
--claim 5--.

[illegible]

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[illegible][illegible][illegible]

DESCRIPTION

BODY-WORN PERSONAL COMMUNICATIONS APPARATUS

5 The present invention relates to a body-worn personal communications apparatus, for example a wrist-carried wireless telephone.

Wireless telephones are generally available either with microphones and loudspeakers built into the main body of the phone, which is then hand-
10 held in a conventional manner, or with headsets which enable the user to operate in a hands-free manner. Progress in miniaturization of electronic components has enabled the production of body-worn personal wireless telephones, which have the advantage of being more convenient to carry and operate than a separate hand-held telephone. The most common example of
15 such a device is a combined wristwatch and wireless telephone, but wireless telephones may also be incorporated in other body-worn goods, for example pendants.

Other types of body-worn personal communications devices include those providing wireless connectivity. An example of such a device is a
20 wristwatch communicator operating according to the Bluetooth specification, which is aimed at short range ad-hoc data and voice wireless communications in both stationary and mobile communication environments. Communication takes place in the unlicensed ISM band at around 2.45GHz. A wristwatch communicator could, for example, function as a user interface to an existing
25 mobile phone, with communication between phone and wristwatch using a Bluetooth link.

A particular problem in the design of wrist-carried communicators is to provide an antenna which is efficient (to maximise battery life), compact (to avoid increasing the bulk of the device) and robust. A great deal of work has
30 been performed in this area. The same problem occurs with other body-worn personal communications devices.

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In a wrist-carried communicator the most common arrangement is to incorporate a magnetic loop antenna into the wristwatch strap, although this approach has to overcome the problems caused by varying wrist sizes and the joins between the strap and watch case and between the two ends of the strap. An example of a strap loop antenna is disclosed in US-A-5,450,091 in which the capacitance between the overlapping strap ends is varied when the wristwatch is worn by users having different wrist sizes, thereby compensating for the change in loop dimensions. Such a design is difficult to make mechanically robust and reliable particularly where the strap is joined to the case. Further, it cannot be used with alternative body-worn transceivers which do not have a strap or equivalent structure into which to incorporate the antenna.

To overcome problems of robustness, attempts have been made to incorporate antennas into the watch casing itself. For example, US-A-5,737,699 discloses a magnetic loop antenna formed within a watch casing. However, the need to accommodate the watch mechanism and transceiver circuitry in the casing complicates the design of the loop antenna and the assembly of the wristwatch telephone.

A number of other antenna designs for mounting inside a watch casing have been proposed, but all suffer from significant problems. Conformal dipoles can be compact but, because of their conformal nature, receive the component of the electric field parallel to the body which is significantly reduced by the presence of the body. Patch antennas with dimensions suitable for use in a watch casing have an inherently low bandwidth, for example between 1 and 2% fractional bandwidth at 2.4GHz. This is much less than the fractional bandwidths required for many applications, for example 4% for Bluetooth (around 2.45GHz), 9% for GSM (Global System for Mobile communications, operating from 880 to 960MHz), and 15% for UMTS (Universal Mobile Telecommunications System, operating from 1900 to 2200MHz).

An object of the present invention is to provide an improved antenna for a personal communications apparatus.

According to the present invention there is provided a body-worn personal communications apparatus comprising an antenna and a casing, the casing having disposed within it transceiver circuitry, characterised in that the antenna is a physically-shortened electric antenna.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, wherein:

Figure 1 is a block schematic diagram of a personal communications apparatus;

Figure 2 is a top view of a wrist-carried personal communications apparatus made in accordance with the present invention;

Figure 3 is a side view of a wrist-carried personal communications apparatus made in accordance with the present invention; and

Figure 4 is a diagram of a helical antenna having an integrated microphone.

In the drawings the same reference numerals have been used to indicate corresponding features.

A block schematic diagram of a personal communications apparatus 100 is shown in Figure 1. This particular example is based on a GSM cellular telephone, but similar principles apply to other cellular telephony standards and to other personal communications apparatus, for example two-way radio.

Consider first the receiver part of the circuitry operating on a voice telephone call. An antenna 102 receives signals from a remote base station, which signals pass through a diplexer filter 104, the purpose of which is to prevent strong transmitted signals from leaking into and overloading receiver circuitry. The signals then pass into a radio frequency transceiver block (RF) 108, which down-converts the RF signal to a lower intermediate frequency (IF).

The IF signals pass to an intermediate frequency block (IF) 110 which down-converts the IF signal to a baseband signal. This signal then passes to a

baseband processing block (BB) 112. This block performs a variety of tasks, including speech decoding, channel decoding and deinterleaving. Received audio signals are converted back to analogue signals for reproduction on a loudspeaker 116 or other suitable output device.

5 Now consider the transmission side of the circuitry. Voice signals are received by a microphone 114, or other suitable input device, and passed to the baseband processing block 112, where they are converted to digital form. The baseband processing block 112 then encodes the speech and performs channel coding and interleaving to reduce the received bit error rate. The
10 resultant signal for transmission is modulated and passed to the IF block 110. Here the baseband signals are transposed up to an IF frequency.

 The IF signal is passed to the RF transceiver block 108 where it is mixed up to the RF transmission frequency and amplified to the required power by a power amplifier (PA) 106. It is then passed through the diplexer
15 filter 104 and transmitted by the antenna 102.

 An embodiment of the present invention will now be described with reference to Figures 2 and 3, which are respectively top and side views of a wrist-carried personal communications apparatus 100. The apparatus comprises a casing 202 and a strap 204. A helical antenna 102 is mounted on
20 the casing, with its axis substantially normal to a plane through the casing 202. The majority of the circuitry for the personal communications apparatus is disposed inside the casing 202 and is coupled to the antenna 102. The microphone 114 and loudspeaker 116 are located behind openings in the casing 202. Also provided is a display 206 and a keyboard 208 for controlling
25 the apparatus 100.

 It is well-known that electromagnetic waves in the vicinity of a human body are significantly affected by the presence of the body. In particular the magnetic field perpendicular to the body is reduced and that parallel to the body is enhanced relative to their free-space values, by up to 6dB (see for
30 example *Mobile Antenna Systems Handbook*, K Fujimoto and J R James, Artech House, 1994, pages 178 to 181). This modification is caused by interference between incident and reflected waves. The electric reflection

coefficient at an interface is the negative of the magnetic reflection coefficient, hence if a component of magnetic field is reduced (because of destructive interference) the same coefficient of electric field will be enhanced (because of constructive interference). Hence, the electric field parallel to the body is reduced and that perpendicular to the body is enhanced by similar amounts to the changes in magnetic field.

The effect of the body on the magnetic field is taken advantage of in pagers, which typically incorporate a loop antenna arranged to be orthogonal to the user's body in operation and therefore to receive the enhanced parallel component of the magnetic field.

The frequencies used for present and future radio communication systems range from around 900 MHz to 2 GHz and higher. At such frequencies, an antenna which receives the electric field component of an electromagnetic wave is in general significantly more efficient than magnetic loop antennas (for similar antenna dimensions). One such antenna is a helical antenna, comprising one or more conductors wound in a helical shape. A helical antenna has a similar efficiency to a dipole antenna, while being rather more compact.

An antenna suitable for use at GSM at around 900 MHz typically has a diameter of 5mm and a height of 10mm. Since the dimensions are related to the wavelength of the electromagnetic waves to be received, at higher frequencies the dimensions of a helical antenna are correspondingly reduced. Hence, it can be seen that the dimensions of a helical antenna make it suitable for use in a GSM wristwatch communicator at 900 MHz, and even more suitable for use in devices operating at higher frequencies.

The transmissions in many radio communication systems have the electric field vertically polarised. When a user is looking at their wristwatch communicator with their arm held out, the face of the communicator will generally be held horizontally. Hence the antenna will be aligned vertically for optimum reception of a vertically polarised transmission. At other times the user's arm will typically be by their side with the result that the antenna will

be aligned horizontally, giving rise to significant polarisation mismatch between the antenna 102 and the transmitted signals.

Most radio communication systems operate in an environment having significant levels of multipath signals. In *Radiowave Propagation and Antennas for Personal Communications*, Second Edition, K. Siwiak, Artech House, 1998, pages 209 to 211, it is shown that such signals typically generate a field of opposite polarisation to the transmitted field at a level of about 6dB below the transmitted field. When combined with the enhancement of the normal component of the electric field by the presence of a human body, the result is that the level of signal received when the communicator is held by the user's side is similar to that received when the communicator is held horizontally in use.

Some additional averaging of performance in different orientations could be provided by a conducting watch casing 202. Since the casing 202 is substantially perpendicular to the axis of the antenna 102 it will have currents induced in it by the opposite polarisation of electric field to that being received by the helical antenna 102. By suitable design of the connection between watch casing 202 and antenna 102 the currents induced in the watch casing can be used to improve the strength of the received signal.

Use of a helical antenna 102 in a wristwatch communicator has a number of advantages over use of other types of antenna. The antenna 102 is not shielded by the watch casing 202 in use, improving efficiency, and operates over a wider bandwidth than patch and loop antennas. In a normal usage position the user's arm held out so that the watch is substantially horizontal and the antenna is substantially vertical. In this position the antenna radiation pattern is substantially omnidirectional in a horizontal plane, providing optimum transmission and reception characteristics.

A convenient modification of the arrangement described above is to mount the microphone 114 on the top of the antenna 102, as illustrated in Figure 4. The helical antenna 102 may be formed of coaxial cable, with a connecting wire 402 connecting the microphone 114 to one end of the cable's inner conductor and the other end of the inner conductor being connected to

ground. A second connecting wire 404 from the microphone 114 is connected to the cable at the top of the antenna 102. Alternatively, the antenna 102 may be formed from hollow wire through which the first connecting wire is passed to connect the microphone to ground.

5 At the bottom of the antenna 102 the audio signals from the microphone 114 and the RF signals received or transmitted by the antenna 102 can easily be separated. A shared connection 406 is made to the outer of the coaxial cable (or the hollow antenna wire) at the bottom of the antenna. From this connection audio signals from the microphone are coupled through a low pass
10 filter (shown here as a single inductor 408) to an audio output 410, while the RF signals are coupled through a high pass filter (shown as a single capacitor 412) to an RF output 412.

Other possibilities could be considered for the connections. For example, two connecting wires from the microphone 114 could pass through a
15 hollow antenna wire, eliminating the need for a filter. Alternatively, the connecting wires could be placed through the centre of the helical antenna 102, enabling the antenna to be formed of solid wire.

A particular advantage of locating the microphone 114 at the top of the antenna 102 is that the microphone package provides top loading (increasing
20 the radiation resistance and reducing the capacitive reactance), thereby enabling use of a shorter antenna 102. In an embodiment where the antenna 102 is formed from coaxial cable, if the microphone 114 also presents a low RF impedance it will provide a short circuit at the top of the helical antenna. The transmission line inside the helix is then a short circuit stub, which
25 provides an inductive impedance thereby reducing the capacitive reactance of the antenna 102 and enabling the use of a still shorter antenna 102.

The embodiments of the present invention described above use a helical antenna 102. However, other types of physically-shortened electric antennas could be used instead. Such antennas are monopole or dipole-like
30 antennas that are physically smaller than their electrical length, and receive predominantly the electric field. An example of such an alternative antenna is a meander-line antenna.

Although the embodiments described above relate to a wristwatch telephone, the invention is equally applicable to other body-worn personal communications apparatus. Examples include pendants, worn around the neck, and brooches, which could be worn when not in use and taken off for use.

Further, the present invention is not restricted to use in telecommunications systems such as GSM, DECT (Digital Enhanced Cordless Telecommunications) and UMTS. Other applications may be found in radio-based local area networks, such as those being defined by the Bluetooth and HomeRF organisations, in which a wristwatch communicator could interact with other devices, such as suitably equipped televisions, computers and mobile phones. Applications could also include earpieces or headphones having a wireless connection.

From reading the present disclosure, other modifications will be apparent to persons skilled in the art. Such modifications may involve other features which are already known in the design, manufacture and use of personal communications apparatus and component parts thereof, and which may be used instead of or in addition to features already described herein.

In the present specification and claims the word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. Further, the word "comprising" does not exclude the presence of other elements or steps than those listed.

CLAIMS

1. A body-worn personal communications apparatus comprising an antenna and a casing, the casing having disposed within it transceiver circuitry, characterised in that the antenna is a physically-shortened electric antenna.

2. An apparatus as claimed in claim 1, characterised in that the physically-shortened electric antenna is a helical antenna.

3. An apparatus as claimed in claim 1, characterised in that the physically-shortened electric antenna is a meander-line antenna.

4. An apparatus as claimed in any one of claims 1 to 3, characterised in that the antenna is mounted transversely to a plane through the casing.

5. An apparatus as claimed in any one of claims 1 to 4, further comprising a microphone, characterised in that the microphone is located at the end of the antenna furthest from the casing.

6. An apparatus as claimed in claim 5, characterised in that the antenna is formed from coaxial cable and in that the coaxial cable provides electrical connections between the microphone and the transceiver circuitry.

7. An apparatus as claimed in claim 5, characterised in that the antenna is formed from hollow wire and in that a first electrical connection between the microphone and the transceiver circuitry is provided by the hollow wire and in that a second electrical connection between the microphone and the transceiver circuitry is provided by a conductor enclosed by the hollow wire.

9. An apparatus as claimed in any one of claims 5 to 8,
characterised in that the microphone provides top loading to the antenna.

ABSTRACT

BODY-WORN PERSONAL COMMUNICATIONS APPARATUS

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In a body-worn personal communications apparatus, for example a wrist-carried wireless telephone, an antenna (102) is a helical or other physically-shortened electric antenna. Such an antenna (102) has good performance in a range of orientations by making use of the enhanced normal component of electric field close to the body.

10

In one embodiment a microphone (114) is located at the top of the antenna (102). The microphone (114) can act as a top load to the antenna, thereby enabling the use of a shorter antenna. The antenna (102) may be formed from coaxial cable, enabling it to provide electrical connections between the microphone (114) and transceiver circuitry in the body of the apparatus. By arranging for the microphone (114) to have low impedance at radio frequencies, the coaxial cable acts as an inductive stub and enables the antenna (102) to be further shortened.

15

20 (Figure 2)

2025 RELEASE UNDER E.O. 14176

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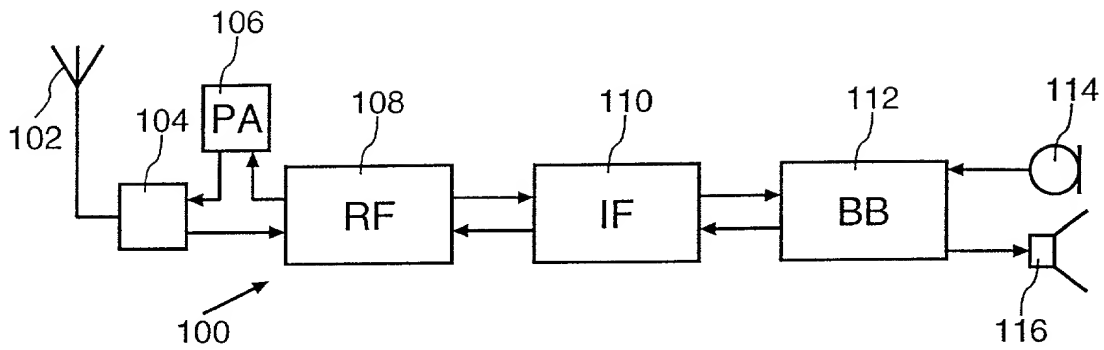


FIG. 1

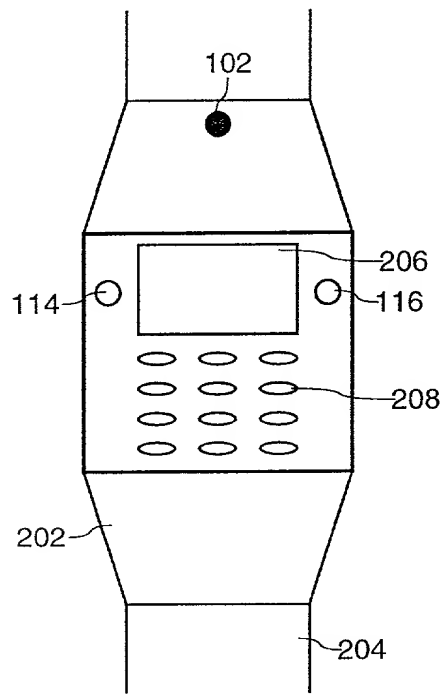


FIG. 2

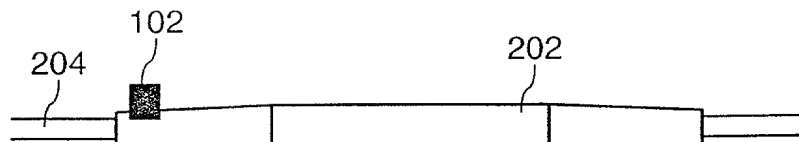


FIG. 3

2/2

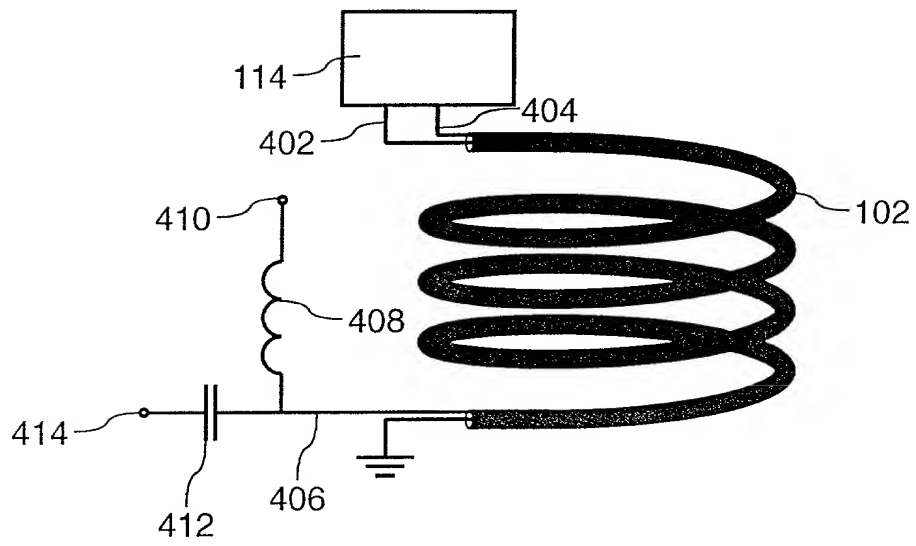


FIG. 4

009220" SE 29T 960

DECLARATION AND POWER OF ATTORNEY

Sole/Joint

Attorney's Docket No:

PHB 34367 US

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

BODY-WORN PERSONAL COMMUNICATIONS APPARATUS

the specification of which (check one)



is attached hereto



was filed on

as Application Serial No: and was amended on

..... (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56 (a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN APPLICATION(S)

COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY Claimed Under 35 U.S.C. 119
GREAT BRITAIN	9917678.6	29-07-1999	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
			Yes <input type="checkbox"/> No <input type="checkbox"/>

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35 United States Code §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

PRIOR UNITED STATES APPLICATION(S)

APPLICATION SERIAL NUMBER	FILING DATE	STATUS (PATENTED, PENDING, ABANDONED)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

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